REMARKS

Reconsideration is respectfully requested in view of the foregoing amendments and the remarks which follow.

Claim 6 has been amended to recite that in the TiO_2 the titanium is tetravalent. This supported in the as-filed specification.

The claims presently pending are 6-9, inclusive.

It is respectfully submitted that claims 6-9, as amended, serve to overcome the rejection of claims 6-9 under 35 USC § 103(a) based on Koyama et al. U.S. Patent Application Publication 2003/0114291 A1 and the § 103(a) rejection based on Landa et al. U.S. 7,169,722. The rejections are traversed.

The Examiner is respectfully requested to reconsider the annexed table which follows wherein certain features of the disclosures of U.S. Patent Application Publication 2003/0114291 A1; and US Patent 7,169,722, the prior art applied by the Examiner against claims 6-10, are compared between each other, including ranges of components and properties of the respective glasses.

The Koyama patent application US 2003/0114291 discloses a glass sheet that has a high transmittance with silica as a main component, and as coloring components, expressed in wt. %: not less than 0.005% to less than 0.02% of total iron oxide in terms of Fe_2O_3 (T-Fe_2O_3); and not more than 0.25% of cerium oxide; less than 0.008% of FeO; wherein the composition has a ratio (FeO ratio) of FeO in terms of Fe_2O_3 to T-Fe_2O_3 of lower than 40%, the glass sheet on 4.0 mm thickness basis has a dominant wavelength of 450 to 580 nm; a solar radiation transmittance of 87.% or higher; an excitation purity of 0.36% or lower; and a visible light transmittance of 90% or higher.

The Koyama patent application does not claim **titanium dioxide.** However, notwithstanding Koyama's comments that the **TiO_2** is not an indispensable ingredient, it can be added in a proper amount for the purpose of enhancing the

ultraviolet-absorbing ability. Koyama discloses that, when an excessive amount of TiO_2 is contained in the glass composition, the glass is more likely to become yellowish, and the transmittance at a wavelength in the vicinity of 500 to 600 nm is lowered. Thus, Koyama teaches that the content of **TiO_2 must be limited to a low level, namely, in the range of less than 0.2%.** In the case of the present invention, the **TiO_2 is in the range from 0.05 to 1 wt %.**

However, it is well known by one of ordinary skill in the glassmaking art, that the sand contains impurities of TiO_2 (the occurrence of Fe_2O_3 impurities is also present in sand) so that Koyama cites as a typical composition the following:

TiO2 = 0.03%, Fe2O3 = 0.10% (see table 4 Example 1)

TABLE 4

Comp. Example	1	2	3	4
SiO_2	72.4	73.07	73.50	70.80
Al_2O_3	1.42	1.80	0.90	1.90
MgO	4.1	0.08	—	3.70
CaO	8.0	10.11	9.00	8.90
SrO	—	0.21	—	—
Na_2O	13.1	14.63	15.80	13.50
K_2O	0.72	0.01	0.29	0.60
SO_3	0.23	0.015	0.30	0.25
T-Fe_2O_3	0.10	0.010	0.1	0.09
TiO_2	0.03	—	0.04	—
Cerium oxide	—	—	—	0.20
ZrO_2	—	0.28	—	—
Total	100.08	99.935	99.93	99.94
FeO	0.027	—	0.028	—
FeO ratio	30	60	31	—
Sheet thickness (mm)	3.20	5.66	3.85	—
Visible light transmittance	90.1	90.8	89.9*	—
Solar radiation transmittance	85.0	88.5	—	—
Ultraviolet transmittance	60.8	—	—	—
Dominant wavelength	502	490.5	541	—
Excitation purity	0.34	0.27	0.30	—
Water resistance	0.51	0.68	1.14	—

*The illuminant A was used as a light source.

[0077] Comparative Example 1 represents a typical soda-lime glass sheet. Comparative Example 2 represents an example disclosed in the above-mentioned JP 7(1995)-

On the other hand, in examples 1 to 18 in Koyama (tables 1, 2 and 3), the % TiO_2 varies between 0.02% to 0.04%. In examples 19 to 30, the TiO_2 is maintained constant at 0.02%, and it is observed that ***TiO_2 is not intentionally added in the glass composition***.

In the claimed invention, the TiO_2 is intentionally added at a level from between 0.05% to 1.0%, by weight, in the glass composition in order **to modify the light transmission**.

Koyama does not claim the addition of TiO_2. To the contrary, in claim 18 (according to claims 1, 9 and 13) Koyama claims that the glass sheet is substantially free from coloring components other than iron oxide, cerium oxide and manganese oxide.

As is well know, the cerium oxide affects, and it has been demonstrated that it modifies, the redox state of the glass. The glasses with added amounts of CeO_2 show a low level of ferrous oxide (FeO).

Finally, the Koyama patent application is only commenting on ***the probability of using the TiO_2*** at page 5, paragraph 0063:

> *[0063] Although not an indispensable component, TiO_2 can be added in a proper amount for the purpose of enhancing an ultraviolet-absorbing ability or the like as long as the amount is in the range that allows the optical properties that are the intended properties of the present invention not to be impaired. When an excessive amount of TiO_2 is contained, the glass becomes more likely to become yellowish, and the transmittance at a wavelength in the vicinity of 500 to 600 nm is lowered. Thus, preferably, the content of TiO_2 is limited to a low level in the range of less than 0.2%.*

Thus, Koyama teaches that the content of **TiO_2 must be limited to a low level, namely, in the range of less than 0.2%.** In the case of the claimed invention, the **TiO_2 is in the range from 0.05 to 1 wt %.**

However, in the case of the present invention the use of the TiO_2 is very critical, which is demonstrated in examples 4, 5 and 6. It directly impacts the light transmission property that is being sought in this product.

TABLE I

Melting glass composition Fe_2O_3—TiO_2

	Sample					
	1	2	3	4	5	6
Thickness (mm)	3.11	3.19	3.15	3.18	3.22	3.08
	% by weight					
Total Iron (Expressed as Fe_2O_3)	0.0125	0.0153	0.0153	0.0237	0.0236	0.0236
TiO_2	0.005	0.005	0.262	0.005	0.262	0.605
FeO (Ferrous expressed as Ferric)	0.0029	0.0034	0.0036	0.0059	0.0054	0.0057
Fe_2O_3 (Ferric)	0.0096	0.0119	0.0117	0.0178	0.0182	0.0179
% Reduction of iron to FeO	23.5	22.0	23.6	24.8	23.1	24.1
TUV (%)	80.5	79.0	79.0	75.6	74.5	75.0
TL (%)	90.1	89.7	90.8	89.5	90.4	91.7
TE (%)	89.4	89.0	89.6	88.3	88.8	89.4
	COLOR TRANSMITTED					
L	94.9	94.7	95.3	94.6	95.1	95.7
Ah	−0.14	−0.17	−0.15	−0.23	−0.23	−0.25
Bh	0.16	0.18	0.22	0.19	0.25	0.27
X	88.3	87.8	87.6	87.6	88.6	89.8
Y	90.1	89.7	90.8	89.5	90.4	91.7
Z	106.3	105.7	102.6	105.5	106.5	107.9
Dominant wavelength	568.9	564.5	569.9	551.2	562.1	559.9
Excitation Purity (%)	0.1	0.1	0.2	0.1	0.1	0.2

Technical papers have been devoted to the behavior of the titanium dioxide (**TiO_2**) in the light transmission of colorless glasses. i.e. Striple, J. H. "Titanium dioxide its effect on the transmission of various glasses", *The Glass Industry*/April 1964, pp 193-196. The author comments that the TiO_2 optically changes the light transmission to a major wavelength, extending the transmission range in the infrared and absorbing more in the ultraviolet.

The more stable form of titanium in the glass is the tetravalent (**Ti^{+4}**), which is colorless, with only the trivalent form (Ti^{3+}) producing color. However, that color is not found in soda-lime-silica glasses. There is no teaching or suggestions in Koyama regarding whether Ti^{3+} or Ti^{4+} should be the valence of TiO_2.

Regarding the Landa et al. patent, it discloses a high transmittance, fairly clear/neutral colored glass composition comprising: SiO_2 at least 67%; Na_2O 10 to 20%; CaO 5 to 15%; MgO 0 to 8% Al_2O_3 0 to 5%; K_2O 0 to 5%; a colorant portion

comprising: total iron (expressed Fe_2O_3); 0.04 to 0.10% cobalt oxide; 0.1 to 15 ppm chromium oxide; 0 to 10 ppm titanium oxide, wherein the glass has a visible transmission of at least about 85%, and wherein the glass contains 0% cerium oxide. **In this case, to compensate for the yellow or yellow-green coloration, a small amount of cobalt (Co) may be provided in the glass to enable it to realize a more neutral color.**

However, there are at least three basic differences between the claimed invention and the disclosure of the Landa patent.

1.- The level of Fe_2O_3.

2.- The glass redox.

3.- The addition of colorants.

1.- The level of Fe_2O_3.

The Landa et al. reference includes a total iron content (expressed herein as Fe_2O_3) from 0.01 to 0.2%. In certain embodiments, the glass may have a total iron content of from 0.01 to 0.15%, more preferably from 0.02 to 0.12%, **and most preferably from 0.04 to 0.10%.**

The claimed invention recites f**rom about 0.01 to 0.03 wt % Fe_2O_3;** from about 20-30% reduction or **Redox** (Fe^{2+}) and from about 0.05 to 1 wt % of TiO_2, the glass having a visible light transmission of at least 87%, an ultraviolet radiation transmittance no more than 81%; a solar direct transmittance of no more than 90%; a dominant wavelength from 600 to 490 nm; and a purity of less than 2%.

The content of Fe_2O_3 (from 0.04-0.10%) in Landa, is possibly due to its use of conventional raw materials.

In the claimed invention it is necessary to use raw materials with a low content of Fe_2O_3, as was described in the specification at page 3, paragraph [0056]:

[0056] To obtain these measures, raw materials with a low content of Fe_2O_3 were requested, which are different than those used in commercial glasses. Sands with a maximum content of 0.010% Fe_2O_3 and dolomites with about 0.03% Fe_2O_3 were used and the limestone was substituted by the calcite about 0.010% Fe_2O_3. An example of a batch mixture that can be used to produce glass of the present invention is as follows:

Batch	Parts by weight
Sand	1000
Soda ash	327.1
Dolomite	256.9
Saltcake	12.3
Calcite	67.8
Aluminum	8.0

2.- The glass redox.

Landa´s patent, in certain of its examples, comments that the resulting glass has a glass redox value of no greater than 0.12 (more preferably <=0.10; even more preferably <=0.08; and most preferably <=0.05). In the present application the reduction is from 20 to 30% or 0.20 to 0.30.

As is explained in the Landa´s patent an oxidizing agent(s) such as cerium oxide (e.g., CeO_2) or the like **(which was not referenced as a colorant)** is added to the glass batch in order to realize very oxidized conditions (i.e., to significantly lower the redox of the resulting glass). **As a result of the oxidizing agent(s) used in the batch, the iron is oxidized to a very low FeO (ferrous state) content**.

$$Fe^{2+} + Ce^{4+} = Fe^{3+} + Ce^{3+}$$

In certain examples illustrating the embodiments of the claimed invention, the resulting glass **has a glass redox value of no greater than 0.12** (more preferably <=0.10; even more preferably <=0.08; and most preferably <=0.05) and an % FeO (i.e.,

ferrous content) of from 0.0001 to 0.05% (more preferably from 0.0001 to 0.01%; most preferably from 0.001 to 0.008%).

In this manner, the claimed invention is protecting an interval from about 20-30% reduction or **Redox** (Fe^{2+}) and from about 0.05 to 1 wt % of TiO_2, the glass having a visible light transmission of at least 87%, an ultraviolet radiation transmittance of no more than 81%; a solar direct transmittance of no more than 90%; a dominant wavelength from 600 to 490 nm; and a purity of less than 2%.

Thus, this is another difference which distinguishes the present invention, wherein the redox is obtained by traditional equilibrium methods, from the Landa reference.

3.- The addition of colorants

In Landa´s patent, the description of the combination of Fe_2O_3-CeO_2 implies a low glass redox value and that the glass may still realize a yellow or yellow-green coloration. In order to compensate for such coloration, a small amount of cobalt (Co) may be provided in the glass to enable it to realize a more neutral color as set forth in certain examples describing embodiments of Landa. Thus, the use of the oxidizing agent(s) decolorizes in a chemical fashion, and the simultaneous use of Co in certain examplary embodiments decolorizes in a physical fashion. **However, one of ordinary skill in the art would know that the "Cobalt" affects the visible transmission in glass where a high transmission is required.**

In relation to the presence of Cr_2O_3 and TiO_2, as well as the Fe_2O, it is well-known by one of ordinary skill in the glassmaking that impurities will be found in the glass composition in very small proportions.

In the case of the present application and finding a basis in the paper "Titanium dioxide its effect on the transmission of various glasses", *The Glass Industry*/April 1964, pp 193-196 (Striple, J. H), the author comments that the TiO_2 optically changes the light transmission to a major wavelength, extending the transmission range in the infrared and absorbing more in the ultraviolet.

The more stable form of titanium in the glass is the tetravalent **(Ti^{4+})**, which is colorless, and only the trivalent form (Ti^{3+}) produces color. However, that color is not to be found in soda-lime-silica glasses.

According to the claimed invention, a soda-lime-silica glass composition is provided which includes ferric oxide and titanium dioxide to produce a colorless glass with a high visible light transmission for use in the construction, appliances, glazing and automotive industry with a thickness of about 2 to 20 mm, and preferably about 3.2 mm.

In summary, applicants have found that:

1. The combination of two or more compounds have an additive effect in the absorption and, therefore, in the final properties of the product.

2. The titanium expressed as **(Ti^{4+})**, provides a colorless glass composition which when added in the glass composition at from between 0.05% to 1.0%, by weight, modifies the light transmission.

3. If cobalt oxide is added to a glass composition (Landa et al. patent), it absorbs at about 590 nm (a combination iron oxide - cobalt oxide), the absorption could be compensated for and still achieve the desired neutral gray tonality, in addition to diminishing the light transmission.

4. The amounts, proportions and oxidation-reduction state of each of the colorants affect four (4) fundamental parameters in the properties of the product, which are: their transmissions in the three zones of the electromagnetic spectrum wherein solar radiation resides, namely, ultraviolet, visible and near infrared (and as a consequence the transmission of total heat), as well as the color to transmission of the glass.

In other words, the color and properties of each particular glass, depends on the following factors: 1) The specific components present in the glass; 2) the valence state of each of the components; 3) the amounts of the specific components; and 4) the specific amounts of the other components.

It is respectfully submitted that Applicants' claimed glass distinguishes over the respective teaching of each of the references and, accordingly, a *prima facie* case of obviousness has not been established. Accordingly, withdrawal of the rejections under 35 U.S.C. § 103 (a) is respectfully solicited.

The issuance of a Notice of Allowance is respectfully solicited.

Please charge any fees which may be due and which have not been submitted herewith to our Deposit Account No. 01-0035.

Respectfully submitted

ABELMAN, FRAYNE & SCHWAB
Attorneys for Applicant

By _____
Jay S. Cinamon
Attorney for Applicant
Reg. No. 24,156

666 Third Avenue
New York, NY 10017-5621
Tel.: (212) 949-9022
Fax: (212) 949-9190

Pub. No. US 2003/0114291	US Patent No. 7,169,722	US Patent No. 10/829093
1. A high transmittance glass sheet formed of a composition comprising silica as a main component and	Claim 1 A glass comprising: a base glass portion comprising: TABLE-US-00011 SiO.sub.2 at least 67% Na.sub.2O 10 to 20% CaO 5 to 15% MgO 0 to 8% Al.sub.2O.sub.3 0 to 5% K.sub.2O 0 to 5%	6. A colorless glass composition having a base glass composition, comprising, in weight percentage: from 70 to 75% of SiO.sub.2; from 10 to 15% of Na.sub.2O; from 5 to 10% of CaO; from 0 to 5% of MgO; from 0.0 to 3% K.sub.2O; from 0.1 to 1.0% Al.sub.2O.sub.3% and compounds consisting of
as coloring components, expressed in wt. %: **not less than 0.005% to less than 0.02% of total iron oxide in terms of Fe.sub.2O.sub.3 (T-Fe.sub.2O.sub.3);**	TABLE-US-00012 total iron (expressed Fe.sub.2O.sub.3): 0.04 to 0.10% Claim 1	from about 0.01 to 0.03% of Fe.sub.2O.sub.3;
wherein the composition has a ratio (FeO ratio) of FeO in terms of Fe.sub.2O.sub.3 to T-Fe.sub.2O.sub.3 of lower than 40%.		from about 20 to 30% reduction (Fe.sup.2+) and
	0.1 to 015 ppm cobalt oxide	
and not more than 0.25% of cerium oxide,		
less than 0.008% of FeO;		
	0.1 to 10 ppm chromium oxide:	
	0 to 10 ppm titanium oxide. (Claim 2: 0 to 0.2% titanium oxide).	**from about 0.05 to 1% of TiO.sub.2,**
wherein the composition has a ratio (FeO ratio) of FeO in terms of Fe.sub.2O.sub.3 to T-Fe.sub.2O.sub.3 of lower than 40% (Redox < 0.4).	**Redox no greater than 0.12**	**Redox 0.2- 0.30**
CLAIM 2. Wherein the glass sheet, on 4.0 mm thickness basis, a **dominat wavelength of 450 to 580 nm,**		a dominant wavelength from 600 nm to 490 nm;
	wherein the glass has **a visible transmission of at least about 85%,** and wherein the glass contains 0% cerium oxide. CLAIM 3. A visible transmission of at least 88%	the glass having a visible light transmission of at least 89%;
a solar radiation trasmittance of 87.% or higher		solar direct transmittance of no more than 90%;
An excitation purity of 0.36% or lower		and a purity of less than 2%.
CLAIM 2. A visible light transmittance of 90% or higher,		
	CLAIM 4. and UV% transmission of no greater than about 75%	an ultraviolet radiation transmittance of no more than 81%;